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Federal Communications Commission
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NOTICE OF INQUIRY COMMENT REVIEW

AVIAN / COMMUNICATION TOWER COLLISIONS

FINAL

Prepared for

FEDERAL COMMUNICATIONS COMMISSION

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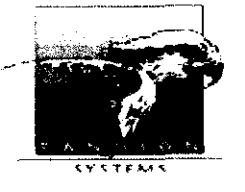

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SECTION 1
INTRODUCTION

1.1 STATEMENT OF THE PROBLEM

As the nation's demand for wireless communication has increased the need for additional telecommunication towers, the potential for bird collisions and the impact on the avian populations have become increasing concerns. As part of its regulatory mandate, the Federal Communications Commission (FCC) is required "*to manage the expansion of the communications infrastructure in a way that best preserves environmental resources.*" Collisions of migratory birds with communication towers and ancillary structures and consequent mortality have been recorded both through observation and anecdotal information (Manville, 2000 a, b; Kerlinger and Curry, 2000). Estimates of tower-related avian mortality vary widely. In part, the uncertainty associated with mortality estimates and the effect on migratory bird populations reflects the challenge of monitoring bird strikes as well as the lack of uniform monitoring procedures and a clearinghouse for these data. In recognition of the need for increased surveillance and better monitoring procedures, industry, agency, and concerned citizen stakeholders and investigators have initiated the development of consistent procedures by which verifiable data can be obtained and evaluated.

On August 20, 2003, the FCC initiated a Notice of Inquiry (NOI) into the *Effects of Communications Towers on Migratory Birds*, FCC 03-205. A summary of the NOI was published in the Federal Register on September 12, 2003. The FCC issued this NOI "*to gather comment and information on the impact that telecommunications towers may have on migratory birds.*" Specifically, information was requested to better determine:

1) the number of migratory bird collisions with communications towers, and

2) the role that specific physical landscape, tower structure, meteorological and other factors may play in the incidence of bird collisions.

In addition, FCC requested comments on mitigating measures that may be considered to reduce or eliminate collisions. As a result of this inquiry, the FCC received approximately 265 comments and responses of varied technical breadth from a variety of commenting agencies, telecommunication and infrastructure support companies, environmental groups, trade associations and concerned citizens. In May 2004, the FCC retained the Avatar Environmental Team, consisting of Avatar Environmental LLC, EDM International, Inc. and Pandion Systems Inc., to review the comments received in response to the NOI with several specific objectives.

1.2 OBJECTIVES

The objectives for this report were outlined in FCC's scope of work for this assignment. To the extent that information was presented in the NOI comments and response to comments, the objectives include:

- *Review and evaluate the available, technically supportable information documenting the number of migratory bird collisions with telecommunications towers;*
- *Review and evaluate the available, technically supportable information available regarding the role that specific factors may increase or decrease the incidence of such collisions.*
- *Recommend actions aimed at obtaining additional data and information necessary to reduce the uncertainty regarding the factors may cause bird collisions and to mitigate potential tower collisions.*
- *Recommend actions aimed at obtaining additional data and information necessary to reduce the uncertainty regarding the factors may cause bird collisions and to mitigate potential tower collisions.*

1.3 GENERAL CAVEATS

In addressing these objectives, this report incorporates only that information that was provided in the comments received in response to the NOI. To the extent these comments incorporated references to studies, these studies were obtained and reviewed to determine the extent to which the results and conclusions of the referenced studies were accurately and adequately characterized.

Also, this review is limited to a review of the scientific and technical information provided in the comments and referenced studies. It was not within the purview of this document to evaluate statements made regarding the regulatory jurisdiction, legal bearing, policy or administrative requirements of the FCC in response to avian collisions with telecommunications towers.

This report is organized in the following sections:

Section 1. Introduction – provides the background information, report objectives and discussion of any limitations regarding the expectations of the report.

Section 2. Technical Approach – presents the methodology by which the objectives were met including the selection of comments and cited studies for inclusion in the report, the approach by which the reviews were conducted, and the method by which data included in the comments and studies were developed and recorded.

Section 3. Bird Collisions with Telecommunications Towers, NOI Comment Review and Study Application - this section of the report provides the information and data presented in the NOI comments and cited studies regarding the degree to which telecommunication structures have resulted in the collision and consequent mortality of migrating birds. It discusses the consistency of the information provided and the confounding factors associated with the estimates.

This section also presents and discusses the extent to which information provided in the comments to the NOI indicates the role that specific physical landscape, tower structure, meteorological, and other factors may play in the incidence of bird collisions. This section discusses the responses to specific questions that FCC raised in its NOI. It summarizes the available information provided by the respondents in their comments and cited studies. The section also presents a summary of the individual respondent's comments on a specific issue.

Section 4. –Section 4 presents data needs, current state-of-the-art mitigation methods and approaches, and information regarding potential mitigation measures that may be considered in reducing bird collisions with towers and guyed wires.

Section 5. Conclusions and Recommendations – presents the report conclusions and recommendations for further actions by the FCC.

Section 6. References. The references used in preparing this report are listed in this section.

SECTION 2
TECHNICAL APPROACH

2.1 COMMENT REVIEW PROCESS

Each of the comments and responses received in response to the NOI were reviewed initially for technical content and comprehensiveness. In addition, the comments were also reviewed for issue redundancy. When the same technical issue was raised in numerous comments, those comments that provided the greatest technical support to a position were selected for a comprehensive review.

2.1.1 Comment Review and Selection Process

Based on the review of approximately 265 comments and responses, this report focused its review and analysis on those comments deemed to be of sufficient technical substance to merit a comprehensive evaluation. The FCC provided these specific comments and reply comments for review and analysis. The comments selected for review are listed in Table 2-1.

2.2 STUDY/CITATION REVIEW PROCESS

Section 3 of this report provides an assessment of the NOI comments and the various studies referenced in those comments. Following the review of the comment documents, a list of select studies and reports cited in each of the comments listed in Table 2-1 was prepared for review and analysis. This initial list was based largely on a cited study's perceived technical substance and the level of dependence on which the commentor's conclusion drew its weight-of evidence from that study. In addition, other ancillary studies were reviewed, based on associated subjects and research focus.

As part of the literature review process (hereafter referred to as "study or studies"), recommended studies were initially segregated into either peer-reviewed or incidental reports/observations categories. Studies cited in peer-reviewed journals were given greater weight for consideration in subsequent discussions in Section 3. A study ranking

hierarchy was employed that incorporated a weight-of-evidence system based on the availability of information provided on key attributes. The availability and the degree of treatment of those attributes determined which studies merited greatest consideration for review and inclusion in this report.

TABLE 2-1

COMMENTS SELECTED FOR COMPREHENSIVE REVIEW

▪ Comments of the Cellular Telecommunications & Internet Association and National Association of Broadcasters	12 November 2003
▪ Comments of the PCIA – The Wireless Infrastructure Association	12 November 2003
▪ Comments of the American Bird Conservancy/ Forest Conservation Council/ Friends of the Earth	11 November 2003
▪ Comments of the U.S. Fish and Wildlife Service	7 November 2003
▪ Comments of the National Association of Tower Erectors	Date not provided
▪ Comments of the Sprint Corporation	12 November 2003
▪ Comments of Cingular Wireless LLC and SBC Communications, Inc	11 December 2003
▪ Joint Written Comments of Don Schellhardt, Esquire and Nickolaus E. Leggett	7 November 2003
▪ Comments of the Chickasaw Nation	Date not provided
▪ Reply Comments of the Cellular Telecommunications and Internet association	11 December 2003
▪ Reply Comments of National Association of Broadcasters	11 December 2003
▪ Reply Comments of National Association for Amateur Radio	1 December 2003

Key study attributes were recorded and maintained in a matrix that allowed for quick overviews, information analysis and sorting. Within each study category, the attributes used in evaluating the usefulness of publications and reports on bird-tower interactions as cited in the comments are presented in Table 2-2. As part of the review process, data for each study was developed using a primary reference review sheet (Table 2-3). Completed review sheets are presented in Appendix A.

Based on the review process, the cited studies used in reviewing the NOI comments are listed in Table 2-4.

TABLE 2-2

ATTRIBUTES EVALUATED AS PART OF THE CITED STUDY ANALYSES

Attribute	Review Characteristics of Attribute
1. Source of Publication	• Is the paper in a peer-reviewed technical journal? • Is it an agency report, or part of an edited conference proceedings? Greatest weight will be given to peer-reviewed papers although many local and regional publications contain important, useful information.
2. Duration of Study	Variability is inherent in bird movements, weather conditions and other natural processes. Characterization of avian-tower interactions at a given site should therefore incorporate some appreciation for year-to year variation and should also recognize seasonal variability between spring and fall migration. Thus, the greatest weight will be given to multi-year studies and those that incorporate spring and fall data.
3. Carcass search methods	Methods used to document numbers of dead birds at towers vary considerably. • Were carcass searches conducted daily or only after nights with overcast and low ceiling? • Were searches conducted only in the fall, or during both spring and fall? Were attempts made to correct the carcass search data for observer bias and/or for scavenger activity? • Was the actual area searched defined or described? Greatest weight will be given to studies that included daily searches, spring and fall, and to studies that evaluated search biases.
4. Number of tower sites	Historically, few studies actually documented consistent bird mortality at more than one tower site. Some papers do incorporate data from multiple sites, however, and provided the data collection methods are consistent and reliable, such multi-site studies will be given greater weight.

TABLE 2-2, CONTINUED

ATTRIBUTES EVALUATED AS PART OF THE CITED STUDY ANALYSES

Attribute	Review Characteristics of Attribute
5. Behavioral observations at the tower	Ideally, a study of avian mortality at a tower will include more than just numbers of dead birds. In particular, behavioral data gathered in a consistent regular manner are preferred. Even opportunistic and irregular observations can be useful, but most weight will be given to studies that included behavioral observations in the design.
6. Documentation of weather factors	Weather is a critical component of avian mortality at towers. The most informative data are those from the actual tower site. Understanding avian mortality at towers requires knowledge of how weather affects behavior of night-flying migrants. Studies are especially useful if weather data are included for all nights, not only those associated with bird kills.
7. Analytical and statistical methods	• Are the data sufficiently robust to warrant statistical analysis? • Are the statistical approaches technically sound? • Do the results support the conclusion?
8. Inclusion of structural and landscape conditions	• Is information about the structural design of the tower available (e.g., height, guyed, and unguyed)? • Is information available pertaining to the towers lighting array? • Is information available regarding the physical setting of the landscape within which the tower is located?

TABLE 2-3

PRIMARY REFERENCE OR NEW DATA REVIEW SHEET

Comment # _____ Issue Type: _____

(Article Number)

I. Citation or Source:

Source Type (check one):

Peer-reviewed Paper ____ **Other (specify):**
Agency Report ____
Conference Proceedings ____

II. Study Objectives (list)

Do study objectives relate to scientific statement of conclusion being evaluated? Yes ____ No ____ Explain

III. Species Studied (list)

IV. Study Methods (briefly list)

V. Duration of Study

Duration (provide dates):	**Seasons:**
Single Year _____	**Spring Migration ____** **Both ____**
Multiple Years _____	**Fall Migration ____** **Yearlong ____**

TABLE 2-3, CONTINUED

Primary Reference or New Data Review Sheet

VI. Carcass Search Methods (if applicable)

Search Conditions: Daily ____ Weekly ____ Only after overcast nights with a low ceiling or storm events ____

Other Periods (Describe):

Search Biases Evaluated, Including Observer Bias and Scavenger Activity? Yes ____ No ____

Search Area Described? Yes ____ No ____

Brief Description of Methods:

VII. Analytical and Statistical Methods

Are the data sufficiently robust to warrant statistical analysis? Yes ____ No ____

Statistical method(s) used: (list)

Are the statistical approaches technically sound? Yes ____ No ____

Do the results support the conclusion? Yes ____ No ____

Comments:

VIII. Number of Tower Sites: Proximity:

IX. Behavioral Observations at the Tower: Yes _____ No _____
Describe if applicable to statement or conclusion being evaluated.

X. Documentation of Weather Factors? Yes _____ No _____
Describe if applicable to statement or conclusion being evaluated.

TABLE 2-3, CONTINUED

Primary Reference or New Data Review Sheet

XI. Inclusion of Structural and Landscape Conditions? Yes ____ No _____ Describe if applicable to statement or conclusion being evaluated.
XII. Current State of Scientific Information (Only applicable if new data or study is provided.)
Is there any new scientific information that has been identified? Yes _____ No ___ If yes explain and evaluate with separate review sheet if new data are provided.
XIII. Need for and Scope of Additional Studies (Only applicable if new data or study is provided.)
Are additional studies identified? Yes ____ No _____ If yes explain and list studies.
XIV. Suggested Methods to Minimize Impacts (Only applicable if new data or study is provided.)
Are specific methods identified? Yes____ No _____ If yes explain and list specific mitigative methods.
Reviewer: Date of Review:
QA'ed by: Date of QA:

TABLE 2-4

PRIMARY STUDIES CITED BY NOI RESPONDENTS AND REVIEWED FOR THIS REPORT

USFWS ID-Peer Review	Cited In Analysis Summary	Author(s)	Title
Yes	No	Able, K.P. 1973.	The changing seasons. American Birds 27(1):19-23.
Yes	No	Aldrich, J.W., R.C. Banks, T.J. Cade, W.A.Calder, F.G. Cooch, S.T. Emlen, G.A. Greenwell, T.R. Howell, J.P. Hubbard, D.W. Johnston, R.F. Johnston, and L.R. Mewaldt. 1975.	Report of the American Ornithologists Union and ad hoc Committee on Scientific and Edcuational Use of Birds. Auk 92 (3, Supple):1-A-27A.
No, But Cited	No	Anderson, R., M. Morrison, K. Sinclair, D. Strickland, H. Davis, and W. Kendall. 1999.	Studying wind energy/bird interactions: a guidance document. Metrics and methods for determining or monitoring potential impacts on birds at existing and proposed wind energy sites. Avian Subcommittee, National Wind Coordinating Committee, Washington, D.C. 87 pp.
Yes	No	Aronoff, A. 1949.	The September migration tragedy. Linnaean News-Letter 3(1):2.
	No	Avery, M.L. and T. Clement. 1972.	Bird mortality at 4 towers in eastern North Dakota: Fall 1972. Prairie Naturalist. 4:87-95.
	Yes	Avery, M.L., P.F. Springer, and J.F. Cassel. 1975.	Progress report on bird losses at the Omega Tower, southeastern North Dakota. North Dakota Academy of Science 27(2):40-49.
Yes	Yes	Avery, M.L., P.F. Springer, and J.F. Cassel. 1976.	The effects of a tall tower on nocturnal bird migration – a portable ceilometer study. Auk 93(2):281-291.
Yes	Yes	Avery, M.L., P.F. Springer, and J.F. Cassel. 1977.	Weather influences on nocturnal bird mortality at a North Dakota tower. Wilson Bulletin 89(2):291-299.
Yes	Yes	Avery, M.L., P.F. Springer, and J.F. Cassel. 1978.	The composition and seasonal variation of bird losses at a tall tower in southeastern North Dakota. American Birds 32(6):1141-1121.
	No	Baird, J. 1970.	Mortality of fall migrants at the Boylston television tower in 1970. The Chickadee 40:17-25.
No, But Cited	Yes	Ball, L.G., K. Zyskowski, and G. Escalona-Segura. 1995.	Recent bird mortality at a Topeka television tower. Kansas Ornithological Society Bulletin 46(4):33-36.
Yes	Yes	Banks, R.C. 1979.	Human related mortality of birds in the United States. U.S. Fish & Wildlife Service, National Fish and Wildlife Lab, Special Scientific Report – Wildlife No. 215:1-16. GPO 848-972.
	Yes	Boso, B. 1965.	Bird casualties at a southern Kansas TV tower. Transactions of the Kansas Academy of Science 68(1):131-136.
	Yes	Brewer, R. and J.A. Ellis. 1958.	An analysis of migrating birds killed at a television tower in east central Illinois. Auk 75(4):400-414.
	Yes	Caldwell, L.D. and G.J. Wallace. 1966.	Collections of migrating birds at Michigan television towers. Jack-Pine Warbler 44:117-123.
Yes	Yes	Caldwell, L.D. and N.L. Cuthbert. 1963.	Bird mortality at television towers near Cadillac, Michigan. The Jack-Pine Warbler 41(2):80-89.

TABLE 2-4

PRIMARY STUDIES CITED BY NOI RESPONDENTS AND REVIEWED FOR THIS REPORT

USFWS ID-Peer Review	Cited in Analysis Summary	Author(s)	Title
	Yes	Carlton, R.G. (editor). 1999.	Avian interactions with utility and communication structures. Proceedings of a Workshop held in Charleston, South Carolina, December 2-3, 1999.
	Yes	Carter, J.H. III and J.F. Parnell. 1976.	TV tower kills in eastern North Carolina. Chat 40:1-9.
	Yes	Carter, J.H. III and J.F. Parnell. 1978.	TV tower kills in eastern North Carolina: 1973 through 1977. Chat 42:67-70.
Yes	Yes	Cochran, W.W. and R.R. Graber. 1958.	Attraction of nocturnal migrants by lights on a television tower. The Wilson Bulletin 70:378-380. (Appears to be a duplicate of Cochran 1958.)
	Yes	Crawford, R.L. 1978.	Autumn bird casualties at a northern Florida TV Tower: 1973-1975. Wilson Bulletin 90(3):335-345.
	Yes	Crawford, R.L. 1981.	Bird casualties at a Leon County, Florida TV tower: a 25-year migration study. *Bulletin of Tall Timbers Research Station* 22:1-30.
	Yes	Crawford, R.L. 1981.	Bird kills at a lighted man-made structure: often on nights close to a full moon. Am. Birds 35:913-914.
Yes	Yes	Crawford, R.L. 1971	Predation on birds killed at TV tower. Oriole 36:33-35.
Yes	Yes	Crawford, R.L. and R.T. Engstrom. 2001.	Characteristics of avian mortality at a north Florida television tower: A 29-year study. J. Field Ornithol. 72(3):380-388.
	No	Curry & Kerlinger (web page)	What kills birds. Available at www.currykerlinger.com/birds.htm
	Yes	Elmore, J.B. Jr. and B. Palmer-Ball Jr. 1991.	Mortality of migrant birds at two central Kentucky TV towers. Kentucky Warbler 67:67-71.
	Yes	Evans, W.R. & A. Manville. 2000.	Avian mortality at communications towers. Transcripts of Proceedings of the Workshop on Avian Mortality at Communications Towers, August 11, 1999, Cornell University, Ithaca, N.Y.
	No	Evans, W.R. 1998.	Telecommunications towers affect avian community. Wave-Guide Information, Tower-Related Bird Kill Rates. http://www.wave-guide.org/archives/waveguide_3/birdkill.html
	Yes	Evans, W.R. 1998.	Two to four million birds a year: calculating avian mortality at communication towers. Bird Calls, American Bird Conservancy, March 1998:1pp.
No, But Cited	Yes	Gauthreaux, S.A., Jr. and C.G. Belser. 2000.	The behavioral reponses of migrating birds to different lighting systems on Tall Towers. 1 p. in W. R. Evans and A. M. Manville II (editors). Transcripts of the proceedings of the workshop on avian mortality at communication towers, August 11, 1999, Cornell University, Ithaca, NY, Published electronically at: http://migratorybirds.fws.gov/issues/towers/agenda.html
	No	Goodpasture, K.A. 1984.	Television tower casualties, Nashville, Tennessee 1976-1983. Migrant 55:53-57.
Yes	Yes	Herndon, L.R. 1973.	Bird kill on Holston Mountain. Migrant 44(1):1-4.
	No	Herron, J. 1997.	*TV transmission tower kills in Lewis County, West Virginia.* Redstart 64:114-117.

TABLE 2-4

PRIMARY STUDIES CITED BY NOI RESPONDENTS AND REVIEWED FOR THIS REPORT

USFWS ID-Peer Review	Cited in Analysis Summary	Author(s)	Title
No, But Cited	No	Johnson, G.D., W.P. Erickson, M.D. Strickland, M.F. Shepherd, D.A. Shepherd, and S.A. Sarappo. 2002.	Collision mortality of local and migrant birds at a large-scale wind power development on Buffalo Ridge, Minnesota. Wildlife Society Bulletin 30(3):879-887.
No, But Cited	Yes	Kemper, C.A. 1996.	A study of bird mortality at a central Wisconsin TV tower from 1957-1995. Passenger Pigeon 58:219-235.
	Yes	Kerlinger, P. 2000a.	Avian mortality at communication towers: a review of recent literature, research, and methodology. Prepared for the USFWS Office of Migratory Bird Management, 2000. Available at: http://migratorybirds.fws.gov/issues/towers/review/pdf
No, But Cited	Yes	Morris, S.R., A.R. Clark, L.H. Bhatti, and J.L. Glasgow. 2003.	Television tower mortality of migrant birds in western New York and Youngtown, Ohio. Northeastern Naturalist 10(1):67-76.
	No	National Wind Coordinating Committee (NWCC). 2001.	Avian collisions with wind turbines: a summary of existing studies and comparisons of avian collision mortality in the United States. Washington D.C.
	No	Nehring, J. (web page)	WSMV tower study summary 1960-1997. http://www.towerkill.com/statereports/TNR/TNdata1a.html
	Yes	Nehring, J. and S. Bivens. 1999.	A study of bird mortality at Nashville's WSMV television tower. Migrant 70:1-8.
	No	Ornithological Council. 1999.	Deadly Spires in the Night. Ornithological Council, 1(8), October, 1999.
No, But Cited	Yes	Podolsky, R, D.G. Ainley, G. Spencer, L. DeForest, and N. Nur. 1998.	Mortality of Newell's Shearwaters caused by collisions with urban structures on Kauai. Colonial Waterbirds 21(1):20-34.
	No	Savereno, A.J., L.A. Savereno, R. Boettcher, and S.M. Haig. 1996.	Avian behavior and mortality at power lines in coastal South Carolina. Wildlife Society Bulletin 24(4):636-648.
	Yes	Seets, J.W. and H.D. Bohlen. 1977.	Comparative mortality of birds at television towers in central Illinois. Wilson Bulletin 89(3):422-433.
No, But Cited	Yes	Shire, G.G., K. Brown, and G. Winegrad. 2000.	Communication towers: A deadly hazard to birds. American Bird Conservancy Special Report. 23 pp.
	Yes	Stoddard, H.L., Sr. 1962.	Bird casualties at a Leon County, Florida TV tower: 1955-1961. Bull. Tall Timbers Res. Sta. 1:94.
	Yes	Stmad, F. 1975.	More birds at KROC-TV tower, Ostrander Minnesota. Loon 47:16-21.
	Yes	Taylor, W.K. and B.H. Anderson. 1973.	Nocturnal migrants killed at a south central Florida TV tower, autumn 1969-1971. Wilson Bulletin 85(1):42-51.
Yes	Yes	Tordoff, H. B. and R.M. Mengel. 1956.	Studies of birds killed in nocturnal migration. University Kansas Museum Natural History Publication 10:1-44.

SECTION 3
BIRD COLLISIONS WITH TELECOMMUNICATIONS TOWERS

This section of the report presents the applicable information and data discussed in the Notice of Inquiry (NOI) comments and cited studies as they pertain to avian collisions with communication towers. Much of this compiled information that correlates with the comments received on the NOI was summarized from both peer- and non-peer reviewed reports, including the results of formal scientific studies as well as anecdotal information and observations. Sections 3.1 and 3.2 address one of the principal objectives of this study:

- *Review and evaluate the available, technically supportable information documenting the number of migratory bird collisions with telecommunications towers.*

3.1 GENERAL OVERVIEW

Recorded bird mortalities and associated monitoring studies at communication tower sites over the last five decades have come under increased scrutiny from regulatory agencies, the communication industry, avian specialists, environmental groups, and the public. However, as apparent from many of the referenced studies and incidental mortality reports for avian collisions with communication towers, little research has been completed on this issue in the last 20 years. Initial studies were conducted from the 1950s through the 1970s, with some studies continuing into the 1990s. On the night of January 22, 1998, an estimated 5,000 to 10,000 Lapland longspurs and other species were killed at three adjacent towers and a natural gas pumping facility in western Kansas. This single night, mass mortality event served as a catalyst to refocus the scrutiny of communication towers on avian mortality and subsequently to mobilize a number of actions in a variety of sectors, from federal to local and from private to industrial.

The first workshop to initiate the dialog regarding bird interactions with communication towers was held at Cornell University on August 11, 1999 (Evans and Manville 2000). Workshop speakers included a variety of prominent ornithological researchers, agency

biologists, regulatory agency representatives, legal council, and communication tower industry personnel. Subsequently, there has been significant interest to further explore the magnitude of this problem and to develop potential solutions to minimize bird mortalities at communication tower structures. In support of this research and to facilitate communications among all the stakeholders, the *Communication Tower Working Group* (CTWG) was established in 1999. The U.S. Fish and Wildlife Service (USFWS) chairs the group, which is composed of a consortium of federal agencies, communication industry representatives, research scientists, conservation organizations, and interested private entities. A Research Subcommittee was appointed to identify research needs and objectives. Periodic workshops and meetings are held to discuss new information and ongoing studies.

In an effort to provide information to the communication tower industry on standardized approaches to minimize the potential for bird strikes at tower sites, the USFWS also developed voluntary guidelines for communication tower siting in October 2000. These guidelines are titled, *U.S. Fish and Wildlife Service Interim Guidelines for Recommendations on Communication Tower Siting, Construction, Operation, and Decommissioning.* Although there has been some debate from the communication tower industry with agencies in certain areas of the country regarding the term "voluntary", the intent of these guidelines was to provide directives and recommendations, based on the "best information available" at the time. These guidelines and the associated *Tower Site Evaluation Form* are available at
http://migratorybirds.fws.gov/issues/towers/comtow.html

The communication towers reporting the largest number of bird kills occur in portions of the heavily forested eastern third of the North American continent (Kemper 1964, Carter and Parnell 1978, Taylor and Anderson 1973, Stoddard 1962, Crawford and Engstrom 2001). In sheer number of migrating birds, detected mortality is substantially higher in the eastern U.S. than that observed in the western states (particularly the states of the interior west including Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming). Although tower kills do occur in the west, it appears that the western migrations are not as prone to nights of high-volume kills. No "mass kills" of birds have

been reported west of Kansas to date. This phenomenon may be associated with several factors, one of which may be that overall populations of migratory birds in the western U.S., especially those migratory species considered to be at the highest risk to tower collisions (e.g., warblers, thrushes, vireos, and finches), are smaller than those occurring in the eastern U.S. and that migration patterns differ between the eastern and western U.S. However, it also is evident that there is a geographical bias of the tower kill studies conducted to date. Of the 47 studies reviewed by Shire et al. (2000), only 14 (fewer than 30 %) were located west of the Mississippi River and none were located west of the Rocky Mountains. Consequently, a more balanced distribution of mortality studies throughout the U.S. is needed before conclusive statements can be made regarding regional differences in avian mortality from communication towers.

As discussed in Section 2.2, the following technical review of avian collisions with communication towers focuses on specific peer-reviewed studies and scientifically based approaches that examined a number of factors historically associated with bird collisions at communication tower sites. This review is not intended to be an exhaustive and all-encompassing literature search of bird kill studies and incidental mortality reports. Kerlinger (2000a) provides a comprehensive summary of studies completed through 2000. Similarly, Woodlot Alternatives (Woodlot) (2003), on behalf of the Cellular Telecommunications & Internet Association (CTIA) and others, presented a literature review of select studies and tower kill reports in response to the FCC's August 20, 2003 NOI request.

This technical review, prepared for the FCC, is structured to focus on the NOI comments received, the applicable studies referenced in those comments, and other ancillary studies that are associated with some of those issues discussed by Woodlot. The Woodlot report summarized a number of other anthropogenic mortality factors for birds associated with avian mortalities throughout the U.S. The report compared these estimated mortality levels and the relative significance of bird collisions with communication towers to the overall national bird populations. Although many of the following discussion topics summarized to address the NOI comments parallel the Woodlot information, the following discussions and analyses do not address the relative significance of bird

mortalities associated with other human-induced causes (e.g., collisions with buildings, vehicles, power lines, wind turbines; effects of cat predation and hunting).

In response to the FCC's request to review the NOI comments and provide a "factual" summary on bird interactions with communication tower operation, the following discussions emphasize 1) the state-of-the-art knowledge regarding bird collisions with communication towers, 2) technically supportable information available regarding the number of birds reported to collide with these structures, and 3) the information available regarding the role that specific factors associated with communication towers may directly increase or decrease the incidence or risk of such collisions.

3.2 REPRESENTATIVE STUDIES AND INCIDENTAL MORTALITY REPORTS

Avian mortalities attributed to collisions with communication towers have been reported throughout North America since communication structures were first developed. Bird kills at tower sites have been documented in the U.S. from the late 1940's and continue to the present (Kerlinger 2000, Towerkill.com 2004).

Some of the more representative and high profile "bird kills" reported at communication towers over the last 50 years are shown in Table 3-1.

Over the last 50 years, a number of incidental mortality records, scientific studies, and anecdotal observations have been reported pertaining to bird kills at and near communication tower sites (Kerlinger 2000a). However, there are limitations in comparing these records due to the lack of continuity in study design (e.g., qualitative observations versus quantitative monitoring), data recording (e.g., anecdotal notes versus formal data records), and estimation biases (e.g., surveyor bias and scavenger removal rates). As previously noted, a number of confounding factors have limited the ability to determine the actual extent of avian mortalities and to make spatial and temporal comparisons of results. The following narrative discusses several of the more important factors.

TABLE 3-1

SIGNIFICANT BIRD MORTALITY EVENTS OVER LAST 50 YEARS

Location	Type of Tower	# of Species / Most Common Species Migratory or Non Migratory	Season, Dates & Duration	Description	Reference
Eastern and Southeastern U.S.	Broadcasting and television towers airport ceilometers, and tall buildings	• 61 species • 51 species • 68 species	Fall October 5-8, 1954	• October 5-6, documented 2,756 individual birds of 61 species at 5 northern locations. • October 6-7 recorded 4,478 birds of 51 species at 10 southern locations. • October 7-8 estimated 99,340 birds of 68 species at 11 of the southernmost locations	Johnston and Haines 1957
Topeka, Kansas	Television Tower, 950 feet	61 species / Nashville warbler, Common yellowthroat Migratory	Fall 11-day period, September – October 1954	Collected 1,090 birds of 61 species during cold fronts with rain, fog and low cloud ceiling	Tordoff and Mengel 1956
Chapel Hill, North Carolina	Television Tower, 78 feet	40 species	Fall September 28, 1956	Estimated 2,500 birds of over 40 species with low cloud ceiling	Trott 1957
WCIA Television Tower, Illinois	Television Tower, 983 feet	41 species / Warblers Migratory	Fall and spring 7 dates between September 1955 and May 1957	During reduced visibility and advancing cold fronts, recorded 486 individual birds of 51 species	Brewer and Ellis 1958